Claims

1. A method (200) of gain calibration for a transceiver having a transmitter unit and a receiver unit and including two feed back coupling paths from the transmitter unit to the receiver unit, the method comprising the steps of:

setting (201) a reference signal level of a feedback signal from the transmitter unit by adjusting characteristics of the transmitter unit in response to the measured signal level;

measuring (203) by a measurement unit, a measurement reference value associated with the reference signal level when sent via a first feed back coupling path;

measuring, by a measurement unit, a signal level transmit on a second feed back coupling path from the transmitter unit via a receiver path;

changing (205) a gain parameter of a transceiver unit of the transceiver by a gain step; and

measuring (207), by the measurement unit a gain adjusted feedback signal level of the second feedback coupling path;

the method characterised by the steps of:

determining (209) an effect of the gain step on the feedback signal level relative to said measurement reference value; and

calibrating (211) the gain step according to said relative effect of the gain step on the feedback signal.

2. A method as claimed in claim 1 wherein the relative effect is determined as a relative change of the at least one measurement with respect to the measurement reference value.

3. A method as claimed in claim 2 wherein the relative effect is determined as the difference between the at least one measurement and the measurement reference value.

4. A method as claimed in claim 1 wherein the relative effect is determined as a relative change in the feedback signal level required to achieve a predefined

relationship between the at least one measurement and the measurement reference value.

5. A method as claimed in claim 4 wherein the predefined relationship is that the at least one measurement is substantially equal to the measurement reference value.

6. A method as claimed in claim 4 or 5 wherein the step of calibrating the gain step comprises determining the gain step as substantially being the same value as the relative effect.

7. A method as claimed in any previous claim, wherein the transmitter comprises a signal generator coupled to the feed back coupling through a transmit path having a transmit path gain and further comprising the step of:

setting a known level at the signal generator;

adjusting the transmit path gain until the measurement unit, when connected to a measurement point through the signal level detector, measures a level equal to the measurement reference value; and

calibrating an absolute value of the transmit path gain as a function of the known signal level and a predetermined relationship between the reference signal level and a measurement value of the measurement unit when connected to the measurement point through the signal level detector.

8. A method as claimed in any previous claim wherein the receiver comprises a receive path having a receive path gain and further comprising the step of calibrating an absolute value of the receive path gain in response to the measurement reference value and the reference signal level.

9. A method as claimed in any of the previous claims wherein the transceiver unit is the transmitter unit having a transmit path having a transmit path gain and the gain step is a gain step of the transmit path gain.

10. A method as claimed in claim 9 wherein the transmitter unit comprises a digital signal generator for generating a calibration signal coupled to the measurement point through the transmit path, the transmit path being an analog transmit path.

11. A method as claimed in claim 10 wherein the gain step is associated with a change of a signal level of the calibration signal and the calibration of the gain step is further in response to the change in the signal level of the calibration signal whereby the feedback signal is maintained within a given dynamic range.

12. A method as claimed in any of the previous claims wherein the transceiver unit is the receiver unit having a receive path gain and the gain step is a gain step of the receive path gain.

13. A method claimed in claim 12 as dependent on any of the claims 4 to 6 wherein the transmitter unit comprises a digital signal generator for generating a calibration signal coupled to the measurement path through a transmit path, and the relative change in the feedback signal level required to achieve a predefined relationship between the at least one measurement and the measurement reference value is determined by adjusting an output level of the digital signal generator.

14. A method as claimed in claim 13 further comprising the step of changing a gain of the transmit path and adjusting the output level of the digital signal generator such that the measurement reference value is measured by the measurement unit.

15. A method as claimed in any of the previous claims wherein the feedback signal is a calibration signal of constant amplitude.

16. A method as claimed in any previous claim wherein the measurement unit is digital and the coupling from the measurement point to the measurement unit through the signal level detector does not comprise any analog signal path of the receiver unit.

17. A method as claimed in any previous claim wherein the steps of changing the gain parameter, measuring the at least one measurement, determining a relative effect and calibrating the gain step are iterated, whereby calibration across a dynamic gain range is achieved.

18. A method as claimed in claim 17 wherein the step of determining the relative effect is further in response to the relative effect determined in previous iterations.

19. A method as claimed in any previous claim wherein the signal level detector has a limited dynamic input range of low distortion, and the reference signal level is set to fall within this dynamic range.

20. A method as claimed in any previous claim further comprising the step of pre-calibrating a measurement of the measurement unit when measuring the reference signal level through the signal level detector.

21. An apparatus (100) for gain calibration for a transceiver having a transmitter unit and a receiver unit having a measurement unit, the apparatus characterised by two feed back coupling paths from the transmitter unit to the receiver unit, the apparatus comprising:

means (169) for setting a reference signal level of the feedback signal from the transmitter unit by adjusting a characteristic of the transmitter unit in response to a measured signal level;

a signal level measurement unit (163) measuring a measurement reference value associated with the reference signal level, when sent via a first feed back coupling path and measuring a signal level transmit on a second feed back coupling path from the transmitter unit via a receiver path;

means for changing a gain parameter of a transceiver unit of the transceiver by a gain step; and

wherein the signal level measurement unit (163) measures a gain adjusted feedback signal level of the second feedback coupling path;

the apparatus (100) characterised by:

means for determining an effect of the gain step on the feedback signal level relative to said measurement reference value; and

means for calibrating the gain step according to said relative effect of the gain step on the feedback signal.

22. An apparatus as claimed in claim 21 wherein the means for determining a relative effect is operable to determine the relative effect as a relative change of the at least one measurement with respect to the measurement reference value.

23. An apparatus as claimed in claim 22 wherein the means for determining a relative effect is operable to determine the relative effect as the difference between the at least one measurement and the measurement reference value.

24. An apparatus as claimed in claim 21 wherein the means for determining a relative effect is operable to determine the relative effect as a relative change in the feedback signal level required to achieve a predefined relationship between the at least one measurement and the measurement reference value.

25. An apparatus as claimed in claim 24 wherein the predefined relationship is that the at least one measurement is substantially equal to the measurement reference value.

26. An apparatus as claimed in claim 24 or 25 wherein the means for calibrating the gain step is operable to determine the gain step as substantially being the same value as the relative effect.

27. An apparatus as claimed in any of the previous claims 21 to 26 further comprising:

a signal generator coupled to the feed back coupling through a transmit path having a transmit path gain;

means for setting a known level at the signal generator;

means for adjusting the transmit path gain until the measurement unit, when connected to a measurement point through the signal level detector, measures a level equal to the measurement reference value; and

means for calibrating an absolute value of the transmit path gain as a function of the known signal level, and a predetermined relationship between the reference

signal level and a measurement value of the measurement unit when connected to the measurement point through the signal level detector.

28. An apparatus as claimed in any of the previous claims 21 to 27 wherein the receiver has a receive path having a receive path gain, the apparatus further comprising means for calibrating an absolute value of the receive path gain in response to the measurement reference value and the reference signal level.

29. An apparatus as claimed in any of the previous claims 21 to 28 wherein the transceiver unit is the transmitter unit having a transmit path having a transmit path gain and the gain step is a gain step of the transmit path gain.

30. An apparatus as claimed in claim 29 further comprising a digital signal generator for generating a calibration signal coupled to the measurement point through the transmit path, the transmit path being an analog transmit path.

31. An apparatus as claimed in claim 30 wherein the gain step is associated with a change of a signal level of the calibration signal and the calibration of the gain step is further in response to the change in the signal level of the calibration signal, whereby the feedback signal is maintained within a given dynamic range.

32. An apparatus as claimed in any of the previous claims 21 to 31 wherein the transceiver unit is the receiver unit having a receive path gain and the gain step is a gain step of the receive path gain.

33. An apparatus as claimed in claim 32 as dependent on any of the claims 24 to 26 further comprising a digital signal generator for generating a calibration signal, the digital signal generator being operable to be coupled to the measurement path through a transmit path, and wherein the means for determining a relative effect is operable to determine the relative change in the feedback signal level required to achieve a predefined relationship between the at least one measurement and the measurement reference value by adjusting an output level of the digital signal generator.

34. An apparatus as claimed in claim 33 further comprising means for changing a gain of the transmit path and adjusting the output level of the digital signal generator such that the measurement reference value is measured by the measurement unit.

35. An apparatus as claimed in any of the previous claims 21 to 34 wherein the feedback signal is a calibration signal of constant amplitude.

36. An apparatus as claimed in any of the previous claims 21 to 35 wherein the measurement unit is digital and the coupling from the measurement point to the measurement unit through the signal level detector does not comprise any analog signal path of the receiver unit.

37. An apparatus as claimed in any of the previous claims 21 to 36 operable to iterate changing the gain parameter, measuring the at least one measurement, determining a relative effect and calibrating the gain step, whereby calibration across a dynamic gain range is achieved.

38. An apparatus as claimed in claim 37 wherein the means for determining a relative effect is operable to determine the relative effect further in response to the relative effect determined in previous iterations.

39. An apparatus as claimed in any of the previous claims 21 to 38 wherein the signal level detector has a limited dynamic input range of low distortion, and the means for setting the reference signal level is operable to set the reference signal level within this dynamic range.

40. An apparatus as claimed in any of the previous claims 21 to 39 further comprising means for storing a pre-calibration value for a measurement of the measurement unit when measuring the reference signal level through the signal level detector.

41. An integrated circuit comprising the apparatus of any of the previous claims 21 to 40.

42. A transceiver unit comprising the apparatus of any of the previous claims 21 to 40.